Constructing the bayesian maps

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1 Bayes' rules

I build this probability from 38 WT embryos in the time window 40-44min. This comes from

`DataPetkova/Data/Gap/gap_data_raw_dorsal_wt.mat`

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$P(x*|h_i) = \frac{P(\{h_i\}|x*)P_x(x*)}{Z(\{h_i\})}$ is the probability of being at x* for given h_is. This is the function Pxh() in my code.

$P(\{h_i\}|x) = \frac{e^{-\chi^2_K(\{h_i\},x)/2}}{\sqrt{(2\pi)^K det(C(x)}}$ where K is the number of h_is (=2) and C is the covariant matrix. This is the function Phx() in my code. It is called the bayesian posterior. h1s and h2s are array with all possible hidden nodes in this time window(40-44 min). avg1 and avg2 are the averages of these array.

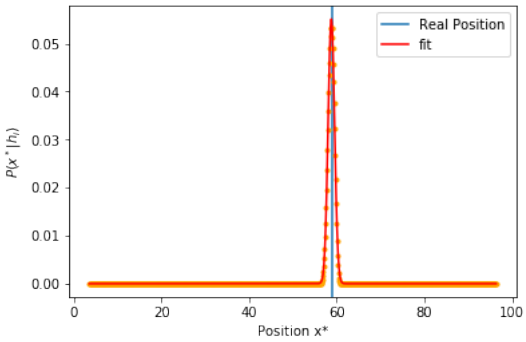
P_x is constant. The probability of being at any position is 1/length of position array.

$Z = \sum_x P(\{h_i\}|x)P_x$ is the normalization. The sum of $P(x*|h_i)$ for all x* should be 1.

2 Building the distribution

If you want to find the position x for given h_i. You need to calculate $P(x*|h_i)$ for all x* along the AP axis.

You can plot all the probability for each x*. This distribution should look gaussian(most of the time). By fitting the gaussian, you get the standard deviation. The mean std for all x and all embryos should be around 1.



3 Building the map

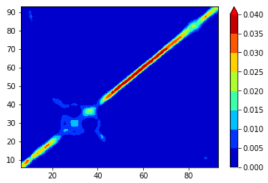
Code in commonFunctions.py in function makeAvgMap().

The map all the distributions for each x on the same image.Hence, we plot x vs x* with $P(x * |h_i(x))$ as the 3rd dimension on the colormap.

To decode, you should use the map for a single embryo. However, Petkova(and I) plot average maps for all embryos.

pseudo code:

```
For loop on embryos
    for loop on x
    Calculate hidden nodes for this x
        for loop on x* (called y in code)
            Calculate $P(x*|{h_i})$
        fit the distribution found in previous loop
        Save (in allRow) the distribution( called row even if it will be a column, my bad)
    Calculate mean of std of all the fits
    Save each individual map( called allRow)
Calculate mean of std of all position
Average all individual map to create an average map
```



4 Building mutant/different time window maps

Use $P(x*|h_i)$ from WT around 42 min, but put in h_i from your new data set.